

Calendar No. 280

108TH CONGRESS
1ST SESSION**S. 189****[Report No. 108–147]**

To authorize appropriations for nanoscience, nanoengineering, and nanotechnology research, and for other purposes.

IN THE SENATE OF THE UNITED STATES

JANUARY 16, 2003

Mr. WYDEN (for himself, Mr. ALLEN, Mr. LIEBERMAN, Mr. WARNER, Ms. MIKULSKI, Mr. HOLLINGS, Ms. LANDRIEU, Mrs. CLINTON, Mr. LEVIN, Mr. BAYH, Mrs. HUTCHISON, Mr. ALEXANDER, Mr. ROCKEFELLER, Mr. CORZINE, Mr. KERRY, Mr. LAUTENBERG, Ms. CANTWELL, and Mr. BAUCUS) introduced the following bill; which was read twice and referred to the Committee on Commerce, Science, and Transportation

SEPTEMBER 15, 2003

Reported by Mr. MCCAIN with an amendment

[Strike out all after the enacting clause and insert the part printed in *italie*]**A BILL**

To authorize appropriations for nanoscience, nanoengineering, and nanotechnology research, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “21st Century
3 Nanotechnology Research and Development Act”.

4 **SEC. 2. FINDINGS.**

5 The Congress makes the following findings:

6 (1) The emerging fields of nanoscience and
7 nanoengineering (collectively, “nanotechnology”), in which
8 matter is manipulated at the atomic level (i.e., atom-by-
9 atom or molecule-by-molecule) in order to build materials,
10 machines, and devices with novel properties or functions,
11 are leading to unprecedented scientific and technological
12 opportunities that will benefit society by changing the way
13 many things are designed and made.

14 (2) Long-term nanoscale research and development
15 leading to potential breakthroughs in areas such as mate-
16 rials and manufacturing, electronics, medicine and
17 healthcare, environment, energy, chemicals, biotechnology,
18 agriculture, information technology, and national security
19 could be as significant as the combined influences of
20 microelectronics, biotechnology, and information tech-
21 nology on the 20th century. Nanotechnology could lead to
22 things such as—

23 (A) new generations of electronics where the en-
24 tire collection of the Library of Congress is stored
25 on devices the size of a sugar cube;

1 (B) manufacturing that requires less material;
2 pollutes less, and is embedded with sophisticated
3 sensors that will internally detect signs of weakness
4 and automatically respond by releasing chemicals
5 that will prevent damage;

6 (C) prosthetic and medical implants whose sur-
7 faces are molecularly designed to interact with the
8 cells of the body;

9 (D) materials with an unprecedented combina-
10 tion of strength, toughness, and lightness that will
11 enable land, sea, air, and space vehicles to become
12 lighter and more fuel efficient;

13 (E) selective membranes that can fish out spe-
14 cific toxic or valuable particles from industrial waste
15 or that can inexpensively desalinate sea water; and

16 (F) tiny robotic spacecraft that will cost less,
17 consume very little power, adapt to unexpected envi-
18 ronments, change its capabilities as needed, and be
19 completely autonomous.

20 (3) Long-term, high-risk research is necessary to cre-
21 ate breakthroughs in technology. Such research requires
22 government funding since the benefits are too distant or
23 uncertain for industry alone to support. Current Federal
24 investments in nanotechnology research and development
25 are not grounded in any specifically authorized statutory

1 foundation. As a result, there is a risk that future funding
2 for long-term, innovative research will be tentative and
3 subject to instability which could threaten to hinder future
4 United States technological and economic growth.

5 (4) The Federal government can play an important
6 role in the development of nanotechnology, as this science
7 is still in its infancy, and it will take many years of sus-
8 tained investment for this field to achieve maturity.

9 (5) Many foreign countries, companies and scientists
10 believe that nanotechnology will be the leading technology
11 of the 21st century and are investing heavily into its re-
12 search. According to a study of international
13 nanotechnology research efforts sponsored by the National
14 Science and Technology Council, the United States is at
15 risk of falling behind its international competitors, includ-
16 ing Japan, South Korea, and Europe if it fails to sustain
17 broad based funding in nanotechnology. The United
18 States cannot afford to fall behind our competitors if we
19 want to maintain our economic strength.

20 (6) Advances in nanotechnology stemming from Fed-
21 eral investments in fundamental research and subsequent
22 private sector development likely will create technologies
23 that support the work and improve the efficiency of the
24 Federal government, and contribute significantly to the ef-
25 forts of the government's mission agencies.

1 (7) According to various estimates, including those
2 of the National Science Foundation, the market for
3 nanotech products and services in the United States alone
4 could reach over \$1 trillion later this century.

5 (8) Nanotechnology will evolve from modern advances
6 in chemical, physical, biological, engineering, medical, and
7 materials research, and will contribute to cross-discipli-
8 nary training of the 21st century science and technology
9 workforce.

10 (9) Mastering nanotechnology will require a unique
11 skill set for scientists and engineers that combine chem-
12 istry, physics, material science, and information science.
13 Funding in these critical areas has been flat for many
14 years and as a result fewer young people are electing to
15 go into these areas in graduate schools throughout the
16 United States. This will have to reverse if we hope to de-
17 velop the next generation of skilled workers with multi-
18 disciplinary perspectives necessary for the development of
19 nanotechnology.

20 (10) Research on nanotechnology creates unprece-
21 dented capabilities to alter ourselves and our environment
22 and will give rise to a host of novel social, ethical, philo-
23 sophical, and legal issues. To appropriately address these
24 issues will require wide reflection and guidance that are
25 responsive to the realities of the science, as well as addi-

1 tional research to predict, understand, and alleviate antici-
 2 pated problems.

3 (11) Nanotechnology will provide structures to enable
 4 the revolutionary concept of quantum computing, which
 5 uses quantum mechanical properties to do calculation.
 6 Quantum computing permits a small number of atoms to
 7 potentially store and process enormous amounts of infor-
 8 mation. Just 300 interacting atoms in a quantum com-
 9 puter could store as much information as a classical elec-
 10 tronic computer that uses all the particles in the universe,
 11 and today's complex encryption algorithms, which would
 12 take today's best super computer 20 billion years, could
 13 be cracked in 30 minutes.

14 (12) The Executive Branch has previously established
 15 a National Nanotechnology Initiative to coordinate Fed-
 16 eral nanotechnology research and development programs.
 17 This initiative has contributed significantly to the develop-
 18 ment of nanotechnology. Authorizing legislation can serve
 19 to establish new technology goals and research directions,
 20 improve agency coordination and oversight mechanisms,
 21 help ensure optimal returns to investment, and simplify
 22 reporting, budgeting, and planning processes for the Exec-
 23 utive Branch and the Congress.

24 (13) The private sector technology innovations that
 25 grow from fundamental nanotechnology research are de-

1 pendent on a haphazard, expensive, and generally ineffi-
2 cient technology transition path. Strategies for accel-
3 erating the transition of fundamental knowledge and inno-
4 vations in commercial products or to support mission
5 agencies should be explored, developed, and when appro-
6 priate, executed.

7 (14) Existing data on the societal, ethical, edu-
8 cational, legal, and workforce implications and issues re-
9 lated to nanotechnology are lacking. To help decision-mak-
10 ers and affected parties better anticipate issues likely to
11 arise with the onset and maturation of nanotechnology,
12 research and studies on these issues must be conducted
13 and disseminated.

14 (15) Many States and regions have begun
15 nanotechnology programs. These programs have developed
16 expertise, particularly with regard to providing infrastruc-
17 ture and preparing the nanotechnology workforce. The
18 Federal nanotechnology program should leverage these ex-
19 isting State and local institutions to best provide a coordi-
20 nated and comprehensive nanotechnology research port-
21 folio.

22 (16) In “Small Wonders, Endless Frontiers” the Na-
23 tional Academy of Sciences’ National Research Council
24 recommends increased investment in nanotechnology, par-
25 ticularly at the intersection of nanotechnology and biology.

1 Such investments will allow significant advancements in
2 biotechnology and medicine.

3 **SEC. 3. PURPOSE.**

4 It is the purpose of this Act to authorize a coordi-
5 nated inter-agency program that will support long-term
6 nanoscale research and development leading to potential
7 breakthroughs in areas such as materials and manufac-
8 turing, nanoelectronics, medicine and healthcare, environ-
9 ment, energy, chemicals, biotechnology, agriculture, infor-
10 mation technology, and national and homeland security.

11 **SEC. 4. NATIONAL NANOTECHNOLOGY RESEARCH PRO-**
12 **GRAM.**

13 (a) NATIONAL NANOTECHNOLOGY RESEARCH PRO-
14 GRAM.—The President shall establish a National
15 Nanotechnology Research Program. Through appropriate
16 agencies, councils, and the National Coordination Office,
17 the program shall—

18 (1) establish the goals, priorities, grand chal-
19 lenges, and metrics for evaluation for Federal
20 nanotechnology research, development, and other ac-
21 tivities;

22 (2) invest in Federal research and development
23 programs in nanotechnology and related sciences to
24 achieve those goals; and

1 (3) provide for interagency coordination of Fed-
2 eral nanotechnology research, development, and
3 other activities undertaken pursuant to the program.

4 (b) GOALS OF THE NATIONAL NANOTECHNOLOGY
5 RESEARCH PROGRAM.—The goals of the program are as
6 follows:

7 (1) The coordination of long-term fundamental
8 nanoscience and engineering research to build a fun-
9 damental understanding of matter enabling control
10 and manipulation at the nanoscale.

11 (2) The assurance of continued United States
12 global leadership in nanotechnology to meet national
13 goals and to support national economic, health, na-
14 tional security, educational, and scientific interests.

15 (3) The advancement of United States produc-
16 tivity and industrial competitiveness through stable,
17 consistent, and coordinated investments in long-term
18 scientific and engineering research in
19 nanotechnology.

20 (4) The development of a network of shared
21 academic facilities and technology centers, including
22 State supported centers, that will play a critical role
23 in accomplishing the other goals of the program, fos-
24 ter partnerships, and develop and utilize next gen-
25 eration scientific tools.

1 (5) The development of enabling infrastructural
2 technologies that United States industry can use to
3 commercialize new discoveries and innovations in
4 nanoscience.

5 (6) The acceleration of the deployment and
6 transition of advanced and experimental
7 nanotechnology and concepts into the private sector.

8 (7) The establishment of a program designed to
9 provide effective education and training for the next
10 generation of researchers and professionals skilled in
11 the multidisciplinary perspectives necessary for
12 nanotechnology.

13 (8) To ensure that philosophical, ethical, and
14 other societal concerns will be considered alongside
15 the development of nanotechnology.

16 (c) RESEARCH AND DEVELOPMENT AREAS.—
17 Through its participating agencies, the National
18 Nanotechnology Research Program shall develop, fund,
19 and manage Federal research programs in the following
20 areas:

21 (1) LONG-TERM FUNDAMENTAL RESEARCH.—

22 The program shall undertake long-term basic
23 nanoscience and engineering research that focuses
24 on fundamental understanding and synthesis of
25 nanometer-size building blocks with potential for

1 breakthroughs in areas such as materials and manu-
2 facturing, nanoelectronics, medicine and healthcare,
3 environment, energy, chemical and pharmaceuticals
4 industries, biotechnology and agriculture, computa-
5 tion and information technology, and national secu-
6 rity. Funds made available from the appropriate
7 agencies under this paragraph shall be used—

8 (A) to provide awards of less than
9 \$1,000,000 each to single investigators and
10 small groups to provide sustained support to in-
11 dividual investigators and small groups con-
12 ducting fundamental, innovative research; and

13 (B) to fund fundamental research and the
14 development of university-industry-laboratory
15 and interagency (including State-led) partner-
16 ships.

17 (2) GRAND CHALLENGES.—The program shall
18 support grand challenges that are essential for the
19 advancement of the field and interdisciplinary re-
20 search and education teams, including multidisci-
21 plinary nanotechnology research centers, that work
22 on major long-term objectives. This funding area will
23 fund, through participating agencies, interdiscipli-
24 nary research and education teams that aim to

1 achieve major, long-term objectives, such as the fol-
 2 lowing:

3 (A) Nanomaterials by design which are
 4 stronger, lighter, harder, self-repairing, and
 5 safer.

6 (B) Nanoelectronics, optoelectronics, and
 7 magnetics.

8 (C) Healthcare applications.

9 (D) Nanoscale processes and environment.

10 (E) Energy and energy conservation.

11 (F) Microspacecraft.

12 (G) Bio-nanodevices for detection and miti-
 13 gation of biothreats to humans.

14 (H) Economical, efficient, and safe trans-
 15 portation.

16 (I) National and homeland security.

17 (J) Other appropriate challenges.

18 ~~(3) INTERDISCIPLINARY NANOTECHNOLOGY RE-~~
 19 ~~SEARCH CENTERS.—~~The Program, through the ap-
 20 propriate agencies, shall fund, on a competitive
 21 merit reviewed basis, research centers in the range
 22 of \$2,000,000 to \$5,000,000 per year each for 5
 23 years. A grant under this paragraph to a center may
 24 be renewed for 1 5-year term on the basis of that
 25 center's performance, determined after a review. The

1 program, through its participating agencies, shall
2 encourage research networking among centers and
3 researchers and require access to facilities to both
4 academia and industry. The centers shall assist in
5 reaching other initiative priorities, including funda-
6 mental research, grand challenges, education, devel-
7 opment and utilization of specific research tools, and
8 promoting partnerships with industry. To the great-
9 est extent possible, agencies participating in the pro-
10 gram shall establish geographically diverse centers
11 including at least one center in a State participating
12 in the National Science Foundation's (NSF) Experi-
13 mental Program, to Stimulate Competitive Research
14 (EPSCoR), established under section 113 of the
15 NSF Authorization Act of 1988 (42 U.S.C. 1862(g))
16 and shall encourage the participation of minority
17 serving institutions at these centers.

18 (4) RESEARCH INFRASTRUCTURE.—The pro-
19 gram, through its participating agencies, shall en-
20 sure adequate research infrastructure and equipment
21 for rapid progress on program goals, including the
22 employment of underutilized manufacturing facilities
23 in areas of high unemployment as production engi-
24 neering and research testbeds for micron-scale tech-
25 nologies. Major research equipment and instrumen-

tation shall be an eligible funding purpose under the program.

~~(5) SOCIETAL, ETHICAL, EDUCATIONAL, LEGAL, AND WORKFORCE ISSUES RELATED TO NANOTECHNOLOGY.~~—The Director of the National Science Foundation shall establish a new Center for Societal, Ethical, Educational, Legal, and Workforce Issues Related to Nanotechnology at \$5,000,000 per year to encourage, conduct, coordinate, commission, collect, and disseminate research on the societal, ethical, educational, legal, and workforce issues related to nanotechnology. The Center shall also conduct studies and provide input and assistance to the Director of the National Science Foundation in completing the annual report required under paragraph 7(b)(3) of this Act.

~~(6) TRANSITION OF TECHNOLOGY.~~—The program, through its participating agencies, shall ensure cooperation and collaboration with United States industry in all relevant research efforts and develop mechanisms to assure prompt technology transition.

~~(7) GAP FUNDING.~~—The program shall address research areas identified by the Council under section 5(a)(9) of this Act through a program of com-

1 petitive grants to be awarded in such areas by the
2 Director of the National Science Foundation using
3 the Foundation's funds and any funds contributed
4 to the Foundation by other participating agencies
5 for this purpose. Such grants may be made to gov-
6 ernment or non-government awardees. Where appro-
7 priate, such grants may encourage interagency part-
8 nerships or leverage the expertise of State-supported
9 nanotechnology programs.

10 **SEC. 5. PROGRAM COORDINATION AND MANAGEMENT.**

11 (a) IN GENERAL.—The National Science and Tech-
12 nology Council shall oversee the planning, management,
13 and coordination of the Federal nanotechnology research
14 and development program. The Council, itself or through
15 an appropriate subgroup it designates or establishes,
16 shall—

17 (1) establish a set of broad applications of
18 nanotechnology research and development, or grand
19 challenges, to be met by the results and activities of
20 the program, based on national needs;

21 (2) submit to the Congress through the Senate
22 Committee on Commerce, Science, and Transpor-
23 tation, and the House of Representatives Committee
24 on Science, an annual report, along with the Presi-

1 dent's annual budget request, describing the imple-
2 mentation of the program under section 4;

3 (3) provide for interagency coordination of the
4 program, including with the Department of Defense;

5 (4) coordinate the budget requests of each of
6 the agencies involved in the program with the Office
7 of Management and Budget to ensure that a bal-
8 anced research portfolio is maintained in order to
9 ensure the appropriate level of research effort;

10 (5) provide guidance each year to the partici-
11 pating departments and agencies concerning the
12 preparation of appropriations requests for activities
13 related to the program;

14 (6) consult with academic, industry, State and
15 local government (including State and regional
16 nanotechnology programs), and other appropriate
17 groups conducting research on and using
18 nanotechnology;

19 (7) establish an Information Services and Ap-
20 plications Council to promote access to and early ap-
21 plication of the technologies, innovations, and exper-
22 tise derived from nanotechnology research and devel-
23 opment program activities to agency missions and
24 systems across the Federal government, and to
25 United States industry;

1 (8) in cooperation with the Advisory Panel es-
 2 tablished under subsection (b), develop and apply
 3 measurements using appropriate metrics for evalu-
 4 ating program performance and progress toward
 5 goals; and

6 (9) identify research areas which are not being
 7 adequately addressed by the agencies' current re-
 8 search programs.

9 (b) PRESIDENT'S NANOTECHNOLOGY ADVISORY
 10 PANEL.—

11 (1) ESTABLISHMENT.—The President shall es-
 12 tablish a National Nanotechnology Advisory Panel.

13 (2) SELECTION PROCEDURES.—The President
 14 shall establish procedures for the selection of individ-
 15 uals not employed by the Federal government who
 16 are qualified in the science of nanotechnology and
 17 other appropriate fields and may, pursuant to such
 18 procedures, select up to 20 individuals, one of whom
 19 shall be designated Chairman, to serve on the Advi-
 20 sory Panel. Selection of individuals for the Advisory
 21 Panel shall be based solely on established records of
 22 distinguished fundamental and applied scientific
 23 service, and the panel shall contain a reasonable
 24 cross-section of views and expertise, including those
 25 regarding the societal, ethical, educational, legal,

1 and workforce issues related to nanotechnology. In
2 selecting individuals to serve on the Advisory Panel,
3 the President shall seek and give due consideration
4 to recommendations from the Congress, industry,
5 the scientific community (including the National
6 Academy of Sciences), scientific professional soci-
7 eties, academia, the defense community, the edu-
8 cation community, State and local governments, and
9 other appropriate organizations.

10 (3) MEETINGS.—The Advisory Panel shall meet
11 no less than twice annually, at such times and places
12 as may be designated by the Chairman in consulta-
13 tion with the National Nanotechnology Coordination
14 Office established under subsection 5(e) of this Act.

15 (4) DUTIES.—The Advisory Panel shall advise
16 the President and the National Science and Tech-
17 nology Council, and inform the Congress, on matters
18 relating to the National Nanotechnology Program,
19 including goals, roles, and objectives within the pro-
20 gram, its capabilities and research needs, guidance
21 on achieving major objectives, and establishing and
22 measuring performance goals using appropriate
23 metrics. The Advisory Panel shall issue an annual
24 report, containing the information required by sub-
25 section (d) of this section, to the President, the

1 Council, the heads of each agency involved in the
 2 program, the Senate Committee on Commerce,
 3 Science, and Transportation, and the House of Rep-
 4 resentatives Committee on Science, on or before Sep-
 5 tember 30 of each year.

6 ~~(c) NATIONAL NANOTECHNOLOGY COORDINATION~~
 7 ~~OFFICE.~~—The President shall establish a National
 8 Nanotechnology Coordination Office, with full-time staff,
 9 to provide day-to-day technical and administrative support
 10 to the Council and the Advisory Panel, and to be the point
 11 of contact on Federal nanotechnology activities for govern-
 12 ment organizations, academia, industry, professional soci-
 13 eties, State nanotechnology programs, and others to ex-
 14 change technical and programmatic information. The Of-
 15 fice shall promote full coordination of research efforts be-
 16 tween agencies, scientific disciplines, and United States in-
 17 dustry.

18 ~~(d) PROGRAM PLANS AND REPORTS.~~—

19 ~~(1) ANNUAL EVALUATION OF NANOTECHNOL-~~
 20 ~~OGY RESEARCH DEVELOPMENT PROGRAM.~~—The re-
 21 port by the Advisory Panel, required pursuant to
 22 subsection (b)(4), shall include—

23 ~~(A) a review of the program's technical~~
 24 ~~success in achieving the stated goals and grand~~

1 challenges according to the metrics established
2 by the program and Advisory Panel;

3 (B) a review of the program's management
4 and coordination;

5 (C) a review of the funding levels by each
6 agency for the program's activities and their
7 ability to achieve the program's stated goals
8 and grand challenges;

9 (D) a review of the balance in the pro-
10 gram's portfolio and components across agen-
11 cies and disciplines;

12 (E) an assessment of the degree of partici-
13 pation in the program by minority serving insti-
14 tutions and institutions located in States par-
15 ticipating in NSF's EPSCoR program;

16 (F) a review of policy issues resulting from
17 advancements in nanotechnology and its effects
18 on the scientific enterprise, commerce, work-
19 force, competitiveness, national security, medi-
20 cine, and government operations;

21 (G) recommendations for new program
22 goals and grand challenges;

23 (H) recommendations for new research
24 areas, partnerships, coordination and manage-
25 ment mechanisms, or programs to be estab-

lished to achieve the program's stated goals and
grand challenges;

(I) recommendations for new investments
by each participating agency in each program
funding area for the 5-year period following the
delivery of the report;

(J) reviews and recommendations regard-
ing other issues deemed pertinent or specified
by the panel; and

(K) a technology transition study which in-
cludes an evaluation of the Federal
nanotechnology research and development pro-
gram's success in transitioning its research,
technologies, and concepts into commercial and
military products, including—

(i) examples of successful transition of
research, technologies, and concepts from
the Federal nanotechnology research and
development program into commercial and
military products;

(ii) best practices of universities, gov-
ernment, and industry in promoting effi-
cient and rapid technology transition in the
nanotechnology sector;

(iii) barriers to efficient technology transition in the nanotechnology sector, including, but not limited to, standards, pace of technological change, qualification and testing of research products, intellectual property issues, and Federal funding; and

(iv) recommendations for government sponsored activities to promote rapid technology transition in the nanotechnology sector.

(2) OFFICE OF MANAGEMENT AND BUDGET REVIEW.—

(A) BUDGET REQUEST REVIEW.—Each Federal agency and department participating in the program shall, as part of its annual request for appropriations, submit information to the Office of Management and Budget including—

(i) each element of its nanotechnology research and development activities that contributes directly to the program or benefits from the program;

(ii) the portion of its request for appropriations that is allocated to each such element; and

1 (iii) the portion of its request for ap-
 2 propriations that is allocated to each pro-
 3 gram funding area.

4 (B) OMB REVIEW AND ALLOCATION
 5 STATEMENT.—The Office of Management and
 6 Budget shall review the information provided
 7 under subparagraph (A) in light of the goals,
 8 priorities, grand challenges, and agency and de-
 9 partmental responsibilities set forth in the an-
 10 nual report of the Council under paragraph (3),
 11 and shall include in the President’s annual
 12 budget estimate, a statement delineating the
 13 amount and portion of each appropriate agen-
 14 cy’s or department’s annual budget estimate re-
 15 lating to its activities undertaken pursuant to
 16 the program.

17 (3) ANNUAL NSTC REPORT TO CONGRESS ON
 18 THE NANOTECHNOLOGY RESEARCH DEVELOPMENT
 19 PROGRAM.—The National Science and Technology
 20 Council shall submit an annual report to the Con-
 21 gress that—

22 (A) includes a detailed description of the
 23 goals, grand challenges, and program funding
 24 areas established by the President for the pro-
 25 gram;

1 (B) sets forth the relevant programs and
2 activities, for the fiscal year with respect to
3 which the budget submission applies, of each
4 Federal agency and department, participating
5 in the program, as well as such other agencies
6 and departments as the President or the Direc-
7 tor considers appropriate;

8 (C) describes the levels of Federal funding
9 for the fiscal year during which such report is
10 submitted, and the levels proposed for the fiscal
11 year with respect to which the budget submis-
12 sion applies, for each of the program funding
13 areas of the program;

14 (D) describes the levels of Federal funding
15 for each agency and department participating
16 in the program and each program funding area
17 for the fiscal year during which such report is
18 submitted, and the levels proposed for the fiscal
19 year with respect to which the budget submis-
20 sion applies, and compare these levels to the
21 most recent recommendations of the Advisory
22 Panel and the external review of the program;

23 (E) describes coordination and partnership
24 activities with State, local, international, and
25 private sector efforts in nanotechnology re-

1 search and development, and how they support
2 the goals of the program;

3 (F) describes mechanisms and efforts used
4 by the program to assist in the transition of in-
5 novative concepts and technologies from Feder-
6 ally funded programs into the commercial sec-
7 tor, and successes in these transition activities;

8 (G) describes coordination between the
9 military and civilian portions, as well as the life
10 science and non-life science portions, of the pro-
11 gram in technology development, supporting the
12 goals of the program, and supporting the mis-
13 sion needs of the departments and agencies in-
14 volved;

15 (H) analyzes the progress made toward
16 achieving the goals, priorities, and grand chal-
17 lenges designated for the program according to
18 the metrics established by the program and the
19 Advisory Panel; and

20 (I) recommends new mechanisms of coordi-
21 nation, program funding areas, partnerships, or
22 activities necessary to achieve the goals, prior-
23 ities, and grand challenges established for the
24 program.

1 (4) TRIENNIAL EXTERNAL REVIEW OF
2 NANOTECHNOLOGY RESEARCH AND DEVELOPMENT
3 PROGRAM.—

4 (A) IN GENERAL.—The Director of the
5 National Science Foundation shall enter into an
6 arrangement with the National Research Coun-
7 cil of the National Academy of Sciences to con-
8 duct a triennial evaluation of the Federal
9 nanotechnology research and development pro-
10 gram, including—

11 (i) a review of the technical success of
12 the program in achieving the stated goals
13 and grand challenges under the metrics es-
14 tablished by the program and the
15 nanotechnology Advisory Panel, and under
16 other appropriate measurements;

17 (ii) a review of the program's manage-
18 ment and coordination across agencies and
19 disciplines;

20 (iii) a review of the funding levels by
21 each agency for the program's activities
22 and their ability with such funding to
23 achieve the program's stated goals and
24 grand challenges;

1 (iv) recommendations for new or re-
2 vised program goals and grand challenges;

3 (v) recommendations for new research
4 areas, partnerships, coordination and man-
5 agement mechanisms, or programs to be
6 established to achieve the program's stated
7 goals and grand challenges;

8 (vi) recommendations for investment
9 levels in light of goals by each partici-
10 pating agency in each program funding
11 area for the 5-year period following the de-
12 livery of the report;

13 (vii) recommendations on policy, pro-
14 gram, and budget changes with respect to
15 nanotechnology research and development
16 activities;

17 (viii) recommendations for improved
18 metrics to evaluate the success of the pro-
19 gram in accomplishing its stated goals;

20 (ix) a review of the performance of
21 the Information Services and Applications
22 Council and its efforts to promote access
23 to and early application of the tech-
24 nologies, innovations, and expertise derived
25 from program activities to agency missions

and systems across the Federal government and to United States industry; and

~~(x)~~ an analysis of the relative position of the United States compared to other nations with respect to nanotechnology research and development, including the identification of any critical research areas where the United States should be the world leader to best achieve the goals of the program.

~~(B) EVALUATION TO BE TRANSMITTED TO CONGRESS.—~~The Director of the National Science Foundation shall transmit the results of any evaluation for which it made arrangements under subparagraph ~~(A)~~ to the Senate Committee on Commerce, Science, and Transportation and the House of Representatives Committee on Science upon receipt. The first such evaluation shall be transmitted no later than June 10, 2005, with subsequent evaluations transmitted to the Committees every 3 years thereafter.

SEC. 6. AUTHORIZATION OF APPROPRIATIONS.

~~(a) NATIONAL SCIENCE FOUNDATION.—~~

1 (1) ~~GENERAL AUTHORIZATION.~~—There are au-
 2 thorized to be appropriated to the Director of the
 3 National Science Foundation to carry out the Direc-
 4 tor's responsibilities under this Act \$346,150,000
 5 for fiscal year 2004.

6 (2) ~~SPECIFIC ALLOCATIONS.~~—

7 (A) ~~INTERDISCIPLINARY NANOTECHNOL-~~
 8 ~~OGY RESEARCH CENTERS.~~—Of the amounts de-
 9 scribed in paragraph (1), \$50,000,000 for fiscal
 10 year 2004, shall be available for grants of up to
 11 \$5,000,000 each for multidisciplinary
 12 nanotechnology research centers.

13 (B) ~~CENTER FOR SOCIETAL, ETHICAL,~~
 14 ~~EDUCATIONAL, LEGAL, AND WORKFORCE~~
 15 ~~ISSUES RELATED TO NANOTECHNOLOGY.~~—Of
 16 the sums authorized for the National Science
 17 Foundation each fiscal year, \$5,000,000 shall
 18 be used to establish a university-based Center
 19 for Societal, Ethical, Educational, Legal, and
 20 Workforce Issues Related to Nanotechnology.

21 (C) ~~NATIONAL NANOTECHNOLOGY COORDI-~~
 22 ~~NATION OFFICE.~~—Of the sums authorized for
 23 the National Science Foundation each fiscal
 24 year, \$5,000,000 shall be used for the activities
 25 of the Nanotechnology Coordination Office.

1 (D) GAP FUNDING.—Of the sums author-
2 ized for the National Science Foundation each
3 fiscal year, \$5,000,000 shall be for use in com-
4 petitive grants as described in section 4(c)(7) of
5 this Act.

6 (b) DEPARTMENT OF ENERGY.—There are author-
7 ized to be appropriated to the Secretary of Energy to carry
8 out the Secretary's responsibilities under this Act
9 \$160,195,000 for fiscal year 2004.

10 (c) NATIONAL AERONAUTICS AND SPACE ADMINIS-
11 TRATION.—There are authorized to be appropriated to the
12 Administrator of the National Aeronautics and Space Ad-
13 ministration to carry out the Administrator's responsibil-
14 ities under this Act \$58,650,000 for fiscal year 2004.

15 (d) NATIONAL INSTITUTES OF HEALTH.—There are
16 authorized to be appropriated to the Director of the Na-
17 tional Institutes to carry out the Director's responsibilities
18 under this Act \$49,680,000 for fiscal year 2004.

19 (e) NATIONAL INSTITUTE OF STANDARDS AND
20 TECHNOLOGY.—There are authorized to be appropriated
21 to the Director of the National Institute of Standards and
22 Technology to carry out the Director's responsibilities
23 under this Act \$50,600,000 for fiscal year 2004.

24 (f) ENVIRONMENTAL PROTECTION AGENCY.—There
25 are authorized to be appropriated to the Administrator of

1 the Environmental Protection Agency to carry out the Ad-
 2 ministrator's responsibilities under this Act \$5,750,000
 3 for fiscal year 2004.

4 (g) DEPARTMENT OF JUSTICE.—There are author-
 5 ized to be appropriated to the Director of the National
 6 Institute of Justice to carry out the Director's responsibil-
 7 ities under this Act \$1,610,000 for fiscal year 2004.

8 (h) DEPARTMENT OF TRANSPORTATION.—There are
 9 authorized to be appropriated to the Secretary of Trans-
 10 portation to carry out the Secretary's responsibilities
 11 under this Act \$2,300,000 for fiscal year 2004.

12 (i) DEPARTMENT OF AGRICULTURE.—There are au-
 13 thorized to be appropriated to the Secretary of Agriculture
 14 to carry out the Secretary's responsibilities under this Act
 15 \$2,870,000 for fiscal year 2004.

16 **SEC. 7. SOCIETAL, ETHICAL, EDUCATIONAL, LEGAL, AND**
 17 **WORKFORCE ISSUES RELATED TO**
 18 **NANOTECHNOLOGY.**

19 (a) STUDIES.—The Director of the National Science
 20 Foundation shall encourage, conduct, coordinate, commis-
 21 sion, collect, and disseminate studies on the societal, eth-
 22 ical, educational, and workforce implications of
 23 nanotechnology through the Center for Societal, Ethical,
 24 Educational, Legal, and Workforce Issues established
 25 under section 4(c)(5). The studies shall identify antici-

1 pated issues and problems, as well as provide rec-
2 ommendations for preventing or addressing such issues
3 and problems.

4 (b) DATA COLLECTION.—The Director of the Na-
5 tional Science Foundation shall collect data on the size
6 of the anticipated nanotechnology workforce need by de-
7 tailed occupation, industry, and firm characteristics, and
8 assess the adequacy of the trained talent pool in the
9 United States to fill such workforce needs.

10 (c) ANNUAL REPORT.—The Director of the National
11 Science Foundation shall compile the studies required by
12 paragraph (2) and, with the assistance of the Center for
13 Societal, Ethical, Educational, Legal, and Workforce
14 Issues Related to Nanotechnology established under sec-
15 tion 4(e)(5) of this Act, shall complete a report that in-
16 cludes a description of the Center's activities, which shall
17 be submitted to the President, the Council, the Senate
18 Committee on Commerce, Science, and Transportation,
19 and the House of Representatives Committee on Science
20 not later than 18 months after the date of enactment of
21 this Act.

22 **SEC. 8. DEFINITIONS.**

23 In this Act:

1 (1) ~~ADVISORY PANEL.~~—The term “Advisory
2 Panel” means the President’s National
3 Nanotechnology Panel.

4 (2) ~~FUNDAMENTAL RESEARCH.~~—The term
5 “fundamental research” means research that builds
6 a fundamental understanding and leads to discov-
7 eries of the phenomena, processes, and tools nec-
8 essary to control and manipulate matter at the
9 nanoscale.

10 (3) ~~GRAND CHALLENGE.~~—The term “grand
11 challenge” means a fundamental problem in science
12 or engineering, with broad economic and scientific
13 impact, whose solution will require the application of
14 nanotechnology.

15 (4) ~~INTERDISCIPLINARY NANOTECHNOLOGY RE-~~
16 ~~SEARCH CENTER.~~—The term “interdisciplinary
17 nanotechnology research center” means a group of 6
18 or more researchers collaborating across scientific
19 and engineering disciplines on large-scale long-term
20 research projects that will significantly advance the
21 science supporting the development of
22 nanotechnology or the use of nanotechnology in ad-
23 dressing scientific issues of national importance,
24 consistent with the goals set forth in section 4(b).

1 (5) NANOTECHNOLOGY.—The term
2 “nanotechnology” means the ability to work at the
3 molecular level, atom-by-atom, to create large struc-
4 tures with fundamentally new molecular organiza-
5 tion.

6 (6) PROGRAM.—The term “program” means
7 the national nanotechnology research program estab-
8 lished under section 4.

9 (7) RESEARCH INFRASTRUCTURE.—The term
10 “research infrastructure” means the measurement
11 science, instrumentation, modeling and simulation,
12 and user facilities needed to develop a flexible and
13 enabling infrastructure so that United States indus-
14 try can rapidly commercialize new discoveries in
15 nanotechnology.

16 **SECTION 1. SHORT TITLE.**

17 *This Act may be cited as the “21st Century*
18 *Nanotechnology Research and Development Act”.*

19 **SEC. 2. NATIONAL NANOTECHNOLOGY PROGRAM.**

20 (a) NATIONAL NANOTECHNOLOGY PROGRAM.—*The*
21 *President shall implement a National Nanotechnology Pro-*
22 *gram. Through appropriate agencies, councils, and the Na-*
23 *tional Nanotechnology Coordination Office established in*
24 *subsection (d), the Program shall—*

1 (1) *Establish the goals, priorities, grand chal-*
2 *lenges, and metrics for evaluation for Federal*
3 *nanotechnology research, development, and other ac-*
4 *tivities;*

5 (2) *Invest in Federal research and development*
6 *programs in nanotechnology and related sciences to*
7 *achieve those goals; and*

8 (3) *Provide for interagency coordination of Fed-*
9 *eral nanotechnology research, development, and other*
10 *activities undertaken pursuant to the Program.*

11 (b) *GOALS.—The goals of the National Nanotechnology*
12 *Program shall include:*

13 (1) *Developing a fundamental understanding of*
14 *matter that enables control and manipulation at the*
15 *nanoscale.*

16 (2) *Ensuring United States global leadership in*
17 *the development and application of nanotechnology.*

18 (3) *Advancing the United States productivity*
19 *and industrial competitiveness through stable, con-*
20 *sistent, and coordinated investments in long-term sci-*
21 *entific and engineering research in nanotechnology.*

22 (4) *Developing a network of shared facilities and*
23 *centers to foster partnerships among researchers in*
24 *nanotechnology.*

1 (5) *Accelerating the deployment and application*
 2 *in the private sector, including startup companies, of*
 3 *nanoscale-related research and development.*

4 (6) *Providing effective education and training*
 5 *for researchers and professionals skilled in the multi-*
 6 *disciplinary perspectives necessary for nanotechnology*
 7 *so that a true interdisciplinary research culture for*
 8 *nanoscale science, engineering, and technology can*
 9 *emerge.*

10 (7) *Ensuring that ethical, legal, environmental,*
 11 *and other appropriate societal concerns are considered*
 12 *during the development of nanotechnology, including*
 13 *safer sustainable nanoscience products and processing.*

14 (c) *PROGRAM MANAGEMENT.—The National Science*
 15 *and Technology Council shall oversee the planning, man-*
 16 *agement, and coordination of the National Nanotechnology*
 17 *Program. The Council, itself or through an appropriate*
 18 *subgroup it designates or establishes, shall—*

19 (1) *establish a set of broad applications of*
 20 *nanotechnology research and development, or grand*
 21 *challenges, to be met by the results and activities of*
 22 *the Program, based on national needs;*

23 (2) *provide for interagency coordination of the*
 24 *Program, including with the activities of the Defense*
 25 *Nanotechnology Research and Development Program*

1 *established under section 246 of the Bob Stump Na-*
2 *tional Defense Authorization Act for Fiscal Year 2003*
3 *(Public Law 107–314);*

4 *(3) develop, within 12 months after the date of*
5 *enactment of this Act, and update every 4 years there-*
6 *after, a strategic plan to meet the goals and priorities*
7 *established under subsection (b) and to guide the ac-*
8 *tivities and anticipated outcomes of the participating*
9 *agencies, including a description of how the Program*
10 *will move results out of the laboratory and into appli-*
11 *cation for the benefit of society, support for long-term*
12 *funding for multidisciplinary research and develop-*
13 *ment in technology, and dedication of funding for*
14 *interagency nanotechnology projects;*

15 *(4) coordinate the budget requests of each of the*
16 *agencies involved in the Program with the Office of*
17 *Management and Budget to ensure that a balanced*
18 *nanotechnology research portfolio is maintained in*
19 *order to ensure the appropriate level of research effort;*

20 *(5) exchange information with academic, indus-*
21 *try, State and local government (including State and*
22 *regional nanotechnology programs), and other appro-*
23 *priate groups conducting research on and using*
24 *nanotechnology;*

1 (6) develop a plan to utilize Federal programs,
2 such as the Small Business Innovation Research Pro-
3 gram and the Small Business Technology Transfer
4 Research Program, in support of the goal stated in
5 subsection (b)(5);

6 (7) identify research areas that are not being
7 adequately addressed by the agencies' current research
8 programs;

9 (8) encourage progress on Program goals through
10 the utilization of existing manufacturing facilities
11 and industrial infrastructures such as, but not lim-
12 ited to, the employment of underutilized manufac-
13 turing facilities in areas of high unemployment as
14 production engineering and research testbeds; and

15 (9) provide for, on a merit-reviewed, competitive
16 basis, interdisciplinary nanotechnology research cen-
17 ters, which to the greatest extent possible, shall be es-
18 tablished in geographically diverse centers including
19 at least one center in a State participating in the Na-
20 tional Science Foundation's (NSF) Experimental
21 Program to Stimulate Competitive Research
22 (EPSCoR), established under section 113 of the NSF
23 Authorization Act of 1988 (42 U.S.C. 1862(g)) and
24 shall encourage the participation of minority serving
25 institutions at these centers.

1 (d) *PROGRAM COORDINATION.*—*The President shall es-*
 2 *tablish a National Nanotechnology Coordination Office,*
 3 *with full-time staff, which shall—*

4 (1) *provide technical and administrative support*
 5 *to the Council and the Advisory Panel;*

6 (2) *serve as the point of contact on Federal*
 7 *nanotechnology activities for government organiza-*
 8 *tions, academia, industry, professional societies, State*
 9 *nanotechnology programs, interested citizen groups,*
 10 *and others to exchange technical and programmatic*
 11 *information;*

12 (3) *conduct public outreach, including dissemi-*
 13 *nation of findings and recommendations of the Advi-*
 14 *sory Panel, as appropriate; and*

15 (4) *establish an office to promote access to and*
 16 *early application of the technologies, innovations, and*
 17 *expertise derived from Program activities to agency*
 18 *missions and systems across the Federal Government,*
 19 *and to United States industry, including startup*
 20 *companies.*

21 (e) *ANNUAL REPORT.*—*The Council shall prepare an*
 22 *annual report, to be submitted to the House of Representa-*
 23 *tives Committee on Science and the Senate Committee on*
 24 *Commerce, Science, and Transportation at the time of the*
 25 *President’s budget request to Congress, that includes—*

1 (1) *the Program budget, for the current fiscal*
2 *year, for each agency that participates in the Pro-*
3 *gram, including a breakout of spending for the devel-*
4 *opment and acquisition of research facilities and in-*
5 *strumentation, for each program component area, and*
6 *for all activities pursuant to subsection (b)(7), which*
7 *shall be submitted by December 31st of such year;*

8 (2) *the proposed Program budget for the next fis-*
9 *cal year, for each agency that participates in the Pro-*
10 *gram, including a breakout of spending for the devel-*
11 *opment and acquisition of research facilities and in-*
12 *strumentation, for each program component area, and*
13 *for all activities pursuant to subsection (b)(7);*

14 (3) *an analysis of the progress made toward*
15 *achieving the goals and priorities established for the*
16 *Program;*

17 (4) *an analysis of the extent to which the Pro-*
18 *gram has incorporated the recommendations of the*
19 *Advisory Panel and the Center, established in section*
20 *7 of this Act; and*

21 (5) *an assessment of how Federal agencies are*
22 *implementing the plan described in section (c)(7),*
23 *and a description of the amount of Small Business*
24 *Innovative Research and Small Business Technology*
25 *Transfer Research funds supporting the plan.*

1 **SEC. 3. ADVISORY PANEL.**

2 (a) *IN GENERAL.*—*The President shall establish or des-*
 3 *ignate a National Nanotechnology Advisory Panel.*

4 (b) *QUALIFICATIONS.*—*The Panel established or des-*
 5 *ignated by the President under subsection (a) shall consist*
 6 *primarily of individuals who are non-Federal members and*
 7 *shall include representatives of academia and industry.*
 8 *Members of such Panel shall be qualified to provide advice*
 9 *and information on nanotechnology research, development,*
 10 *demonstrations, education, technology transfer, commercial*
 11 *application, or societal and ethical concerns. In selecting*
 12 *or designating an Advisory Panel, the President may also*
 13 *seek and give consideration to recommendations from the*
 14 *Congress, industry, the scientific community (including the*
 15 *National Academy of Sciences), scientific professional soci-*
 16 *eties, academia, the defense community, State and local*
 17 *governments, regional nanotechnology programs, and other*
 18 *appropriate organizations.*

19 (c) *DUTIES.*—*The Panel shall advise the President and*
 20 *the Council on matters relating to the Program, including*
 21 *assessing—*

22 (1) *trends and developments in nanotechnology*
 23 *science and engineering;*

24 (2) *progress made in implementing the Program;*

25 (3) *the need to revise the Program;*

1 (4) *the balance among the components of the*
 2 *Program, including funding levels for the program*
 3 *component areas;*

4 (5) *whether the Program component areas, prior-*
 5 *ities, and technical goals developed by the Council are*
 6 *helping to maintain United States leadership in*
 7 *nanotechnology;*

8 (6) *the management, coordination, implementa-*
 9 *tion, and activities of the Program; and*

10 (7) *whether societal, ethical, environmental, and*
 11 *workforce concerns are adequately addressed by the*
 12 *Program.*

13 (d) *REPORTS.—The Advisory Panel shall report, not*
 14 *less frequently than once every 2 fiscal years, to the Presi-*
 15 *dent, the Senate Committee on Commerce, Science, and*
 16 *Technology, and the House of Representatives Committee on*
 17 *Science on its assessments under subsection (c) and its rec-*
 18 *ommendations for ways to improve the Program. The first*
 19 *report under this subsection shall be submitted within 1*
 20 *year after the date of enactment of this Act.*

21 (e) *TRAVEL EXPENSES OF NON-FEDERAL MEM-*
 22 *BERS.—Non-Federal members of the Panel, while attending*
 23 *meetings of the Panel or while otherwise serving at the re-*
 24 *quest of the head of the Panel away from their homes or*
 25 *regular places of business, may be allowed travel expenses,*

1 *including per diem in lieu of subsistence, as authorized by*
 2 *section 5703 of title 5, United States Code, for individuals*
 3 *in the Government serving without pay. Nothing in this*
 4 *subsection shall be construed to prohibit members of the*
 5 *Panel who are officers or employees of the United States*
 6 *from being allowed travel expenses, including per diem in*
 7 *lieu of subsistence, in accordance with existing law.*

8 **SEC. 4. TRIENNIAL EXTERNAL REVIEW OF NANOTECH-**
 9 **NOLOGY RESEARCH AND DEVELOPMENT PRO-**
 10 **GRAM.**

11 *(a) IN GENERAL.—The Director of the National*
 12 *Science Foundation shall enter into an arrangement with*
 13 *the National Research Council of the National Academy of*
 14 *Sciences to conduct a triennial evaluation of the National*
 15 *Nanotechnology Program, including—*

16 *(1) a review of the technical success of the Pro-*
 17 *gram in achieving the stated goals under the metrics*
 18 *established by the Program and the Advisory Panel,*
 19 *and under other appropriate measurements;*

20 *(2) a review of the Program’s management and*
 21 *coordination across agencies and disciplines;*

22 *(3) a review of the funding levels by each agency*
 23 *for the Program’s activities and their ability with*
 24 *such funding to achieve the Program’s stated goals;*

1 (4) *recommendations for new or revised Program*
2 *goals;*

3 (5) *recommendations for new research areas,*
4 *partnerships, coordination and management mecha-*
5 *nisms, or programs to be established to achieve the*
6 *Program's stated goals;*

7 (6) *recommendations for investment levels by*
8 *each participating agency in each Program funding*
9 *area for the 5-year period following the delivery of*
10 *the report;*

11 (7) *recommendations on policy, program, and*
12 *budget changes with respect to nanotechnology re-*
13 *search and development activities;*

14 (8) *recommendations for improved metrics to*
15 *evaluate the success of the Program in accomplishing*
16 *its stated goals;*

17 (9) *a review of the performance of the National*
18 *Nanotechnology Coordination Office and its efforts to*
19 *promote access to and early application of the tech-*
20 *nologies, innovations, and expertise derived from pro-*
21 *gram activities to agency missions and systems across*
22 *the Federal Government and to United States indus-*
23 *try; and*

24 (10) *an analysis of the relative position of the*
25 *United States compared to other nations with respect*

1 to nanotechnology research and development, includ-
 2 ing the identification of any critical research areas
 3 where the United States should be the world leader to
 4 best achieve the goals of the Program.

5 (b) *EVALUATION TO BE TRANSMITTED TO CON-*
 6 *GRESS.*—*The Director of the National Science Foundation*
 7 *shall transmit the results of any evaluation for which it*
 8 *made arrangements under subsection (a) to the Advisory*
 9 *Panel, the Senate Committee on Commerce, Science, and*
 10 *Transportation and the House of Representatives Com-*
 11 *mittee on Science upon receipt. The first such evaluation*
 12 *shall be transmitted no later than June 10, 2005, with sub-*
 13 *sequent evaluations transmitted to the Committees every 3*
 14 *years thereafter.*

15 **SEC. 5. AUTHORIZATION OF APPROPRIATIONS.**

16 (a) *NATIONAL SCIENCE FOUNDATION.*—

17 (1) *IN GENERAL.*—*There are authorized to be ap-*
 18 *propriated to the Director of the National Science*
 19 *Foundation to carry out the Director’s responsibilities*
 20 *under this Act—*

21 (A) \$350,000,000 for fiscal year 2004;

22 (B) \$385,000,000 for fiscal year 2005;

23 (C) \$424,000,000 for fiscal year 2006;

24 (D) \$449,000,000 for fiscal year 2007; and

25 (E) \$476,000,000 for fiscal year 2008.

1 (2) *SPECIFIC ALLOCATIONS.*—

2 (A) *INTERDISCIPLINARY NANOTECHNOLOGY*
3 *RESEARCH CENTERS.*—*Of the amounts author-*
4 *ized by paragraph (1) for each fiscal year,*
5 *\$50,000,000 for each fiscal year shall be avail-*
6 *able for grants of up to \$5,000,000 each for mul-*
7 *tidisciplinary nanotechnology research centers.*

8 (B) *AMERICAN NANOTECHNOLOGY PRE-*
9 *PAREDNESS CENTER.*—*Of the amounts author-*
10 *ized by paragraph (1) for each fiscal year,*
11 *\$5,000,000 shall be used to establish and main-*
12 *tain a university-based American Nanotech-*
13 *nology Preparedness Center.*

14 (C) *NATIONAL NANOTECHNOLOGY COORDI-*
15 *NATION OFFICE.*— *Of the sums authorized by*
16 *paragraph (1) for each fiscal year, \$5,000,000*
17 *shall be used for the activities of the*
18 *Nanotechnology Coordination Office.*

19 (D) *MANUFACTURING TECHNOLOGIES FOR*
20 *NANOMATERIALS.*—*Of the sums authorized by*
21 *paragraph (1) for each fiscal year, \$5,000,000*
22 *shall be used for the activities of the Center for*
23 *Nanomaterials Manufacturing.*

24 (b) *DEPARTMENT OF ENERGY.*—

1 (1) *IN GENERAL.*—*There are authorized to be ap-*
 2 *propriated to the Secretary of Energy to carry out the*
 3 *Secretary’s responsibilities under this Act—*

4 (A) *\$265,000,000 for fiscal year 2004;*

5 (B) *\$292,000,000 for fiscal year 2005;*

6 (C) *\$321,000,000 for fiscal year 2006;*

7 (D) *\$340,000,000 for fiscal year 2007; and*

8 (E) *\$360,000,000 for fiscal year 2008.*

9 (2) *ALLOCATION.*—*Of the sums authorized by*
 10 *paragraph (1) for each fiscal year, \$25,000,000 shall*
 11 *be used on a merit-reviewed and competitive basis to*
 12 *support consortia that integrate newly developed*
 13 *nanotechnology and microfluidic tools with systems*
 14 *biology, immunology, and molecular imaging, of*
 15 *which at least 1 such consortium shall be provided*
 16 *with at least \$10,000,000 for each fiscal year.*

17 (c) *NATIONAL AERONAUTICS AND SPACE ADMINISTRA-*
 18 *TION.*—*There are authorized to be appropriated to the Ad-*
 19 *ministrator of the National Aeronautics and Space Admin-*
 20 *istration to carry out the Administrator’s responsibilities*
 21 *under this Act—*

22 (1) *\$31,000,000 for fiscal year 2004;*

23 (2) *\$34,100,000 for fiscal year 2005;*

24 (3) *\$37,500,000 for fiscal year 2006;*

25 (4) *\$40,000,000 for fiscal year 2007; and*

1 (5) \$42,300,000 for fiscal year 2008.

2 (d) *NATIONAL INSTITUTES OF HEALTH*.—*There are*
 3 *authorized to be appropriated to the Director of the Na-*
 4 *tional Institutes to carry out the Director's responsibilities*
 5 *under this Act—*

6 (1) \$70,000,000 for fiscal year 2004;

7 (2) \$77,000,000 for fiscal year 2005;

8 (3) \$85,000,000 for fiscal year 2006;

9 (4) \$90,000,000 for fiscal year 2007; and

10 (5) \$95,000,000 for fiscal year 2008.

11 (e) *NATIONAL INSTITUTE OF STANDARDS AND TECH-*
 12 *NOLOGY*.—*There are authorized to be appropriated to the*
 13 *Director of the National Institute of Standards and Tech-*
 14 *nology to carry out the Director's responsibilities under this*
 15 *Act—*

16 (1) \$62,000,000 for fiscal year 2004;

17 (2) \$68,200,000 for fiscal year 2005;

18 (3) \$75,000,000 for fiscal year 2006;

19 (4) \$80,000,000 for fiscal year 2007; and

20 (5) \$84,000,000 for fiscal year 2008.

21 (f) *ENVIRONMENTAL PROTECTION AGENCY*.—*There are*
 22 *authorized to be appropriated to the Administrator of the*
 23 *Environmental Protection Agency to carry out the Admin-*
 24 *istrator's responsibilities under this Act—*

25 (1) \$5,000,000 for fiscal year 2004;

- 1 (2) \$5,500,000 for fiscal year 2005;
- 2 (3) \$6,050,000 for fiscal year 2006;
- 3 (4) \$6,413,000 for fiscal year 2007; and
- 4 (5) \$6,800,000 for fiscal year 2008.

5 (g) *DEPARTMENT OF JUSTICE.*—*There are authorized*
 6 *to be appropriated to the Director of the National Institute*
 7 *of Justice to carry out the Director’s responsibilities under*
 8 *this Act—*

- 9 (1) \$1,000,000 for fiscal year 2004;
- 10 (2) \$1,100,000 for fiscal year 2005;
- 11 (3) \$1,210,000 for fiscal year 2006;
- 12 (4) \$1,283,000 for fiscal year 2007; and
- 13 (5) \$1,360,000 for fiscal year 2008.

14 (h) *DEPARTMENT OF HOMELAND SECURITY.*—*There*
 15 *are authorized to be appropriated to the Secretary of Home-*
 16 *land Security to carry out the Secretary’s responsibilities*
 17 *under this Act—*

- 18 (1) \$2,000,000 for fiscal year 2004;
- 19 (2) \$2,200,000 for fiscal year 2005;
- 20 (3) \$2,420,000 for fiscal year 2006;
- 21 (4) \$2,570,000 for fiscal year 2007; and
- 22 (5) \$2,720,000 for fiscal year 2008.

23 (i) *DEPARTMENT OF AGRICULTURE.*—*There are au-*
 24 *thorized to be appropriated to the Secretary of Agriculture*

1 *to carry out the Secretary's responsibilities under this*
 2 *Act—*

- 3 (1) \$10,000,000 for fiscal year 2004;
- 4 (2) \$11,000,000 for fiscal year 2005;
- 5 (3) \$12,100,000 for fiscal year 2006;
- 6 (4) \$12,830,000 for fiscal year 2007; and
- 7 (5) \$13,600,000 for fiscal year 2008.

8 **SEC. 6. AMERICAN NANOTECHNOLOGY PREPAREDNESS**
 9 **CENTER.**

10 (a) *IN GENERAL.*—*The Director of the National*
 11 *Science Foundation shall, on a merit-reviewed and competi-*
 12 *tive basis, establish a new American Nanotechnology Pre-*
 13 *paredness Center to encourage, conduct, coordinate, com-*
 14 *mission, collect, and disseminate research on the edu-*
 15 *cational, legal, workforce, societal, and ethical issues related*
 16 *to nanotechnology.*

17 (b) *STUDIES.*—*The Director of the National Science*
 18 *Foundation, through the Center, shall conduct, coordinate,*
 19 *commission, collect, and disseminate studies on the edu-*
 20 *cational, legal, workforce, societal, and ethical implications*
 21 *of nanotechnology. The studies shall identify anticipated*
 22 *issues and problems, as well as provide recommendations*
 23 *for preventing or addressing such issues and problems.*

24 (c) *WORKFORCE DATA.*—*The Director of the National*
 25 *Science Foundation shall collect data on the size of the an-*

1 *ticipated nanotechnology workforce need by detailed occupa-*
 2 *tion, industry, and firm characteristics, and assess the ade-*
 3 *quacy of the trained talent pool in the United States to*
 4 *fill such workforce needs.*

5 *(d) ANNUAL REPORT.—The Director of the National*
 6 *Science Foundation shall compile the studies required by*
 7 *paragraph (b) and, with the assistance of the Center, shall*
 8 *complete a report that includes a description of the Center’s*
 9 *activities, which shall be submitted to the President, the*
 10 *Council, the Advisory Panel, the Senate Committee on Com-*
 11 *merce, Science, and Transportation, and the House of Rep-*
 12 *resentatives Committee on Science not later than 18 months*
 13 *after the date of enactment of this Act.*

14 **SEC. 7. COMMERCIALIZATION ISSUES RELATED TO NANO-**
 15 **SCIENCE AND NANOTECHNOLOGY.**

16 *(a) IN GENERAL.—The Director of the National Insti-*
 17 *tute of Standards and Technology shall establish a center*
 18 *within NIST’s Manufacturing Engineering Laboratory for*
 19 *issues relating to the commercialization of nanoscience and*
 20 *nanotechnology research. The program shall—*

21 *(1) conduct basic research on issues related to the*
 22 *development and manufacture of nanotechnology in-*
 23 *cluding—*

24 *(A) metrology;*

25 *(B) reliability and quality assurance;*

1 (C) processes control; and

2 (D) manufacturing best practices; and

3 (2) in consultation with the National Technical
4 Information Service and the National Nanotechnology
5 Coordination Office, act as a clearinghouse for infor-
6 mation related to commercialization of nanoscience
7 and nanotechnology research, including—

8 (A) information relating activities by re-
9 gional, state, and local commercial nanotech-
10 nology initiatives;

11 (B) transition of research, technologies, and
12 concepts from Federal nanotechnology research
13 and development programs into commercial and
14 military products;

15 (C) best practices by government, university
16 and private sector laboratories transitioning
17 technology to commercial use;

18 (D) examples of ways to overcome barriers
19 and challenges to technology deployment; and

20 (E) use of existing manufacturing infra-
21 structure and workforce.

22 (b) *USE OF MANUFACTURING EXTENSION PARTNER-*
23 *SHIP PROGRAM.*—The Director of the National Institute of
24 Standards and Technology shall utilize the manufacturing

1 *extension partnership program to the extent possible to*
 2 *reach small and medium sized manufacturing companies.*

3 (c) *MANUFACTURING TECHNOLOGIES FOR*
 4 *NANOMATERIALS.—The Director of the National Science*
 5 *Foundation shall establish, on a merit-reviewed, competi-*
 6 *tive basis, a new Center for Nanomaterials Manufacturing*
 7 *to encourage the development and transfer of technologies*
 8 *for the manufacture of nanomaterials. The Center will en-*
 9 *courage, conduct, coordinate, commission, collect, and dis-*
 10 *seminate research on new manufacturing technologies for*
 11 *materials with unprecedented combinations of strength,*
 12 *toughness, lightness, flame resistance, and membrane sepa-*
 13 *ration characteristics, and develop mechanisms to transfer*
 14 *such manufacturing technologies to United States indus-*
 15 *tries.*

16 **SEC. 8. DEFINITIONS.**

17 *In this Act:*

18 (1) *ADVISORY PANEL.—The term “Advisory*
 19 *Panel” means the President’s National Nano-*
 20 *technology Panel established or designated under sec-*
 21 *tion 3.*

22 (2) *FUNDAMENTAL RESEARCH.—The term “fun-*
 23 *damental research” means research that builds a fun-*
 24 *damental understanding and leads to discoveries of*

1 *the phenomena, processes, and tools necessary to con-*
 2 *trol and manipulate matter at the nanoscale.*

3 (3) *NANOTECHNOLOGY.—The term “nanotech-*
 4 *nology” means the ability to work at the molecular*
 5 *level, atom-by-atom, to create large structures with*
 6 *fundamentally new molecular organization.*

7 (4) *PROGRAM.—The term “Program” means the*
 8 *National Nanotechnology Program established under*
 9 *section 2.*

10 (5) *COUNCIL.—The term “Council” means the*
 11 *National Science and Technology Council or an ap-*
 12 *propriate subgroup designated by the Council under*
 13 *section 2(c).*

14 (6) *GRAND CHALLENGE.—The term “grand chal-*
 15 *lenge” means a fundamental problem in science or*
 16 *engineering, with broad potential economic and sci-*
 17 *entific impact, the solution to which will require the*
 18 *application of nanotechnology research.*

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S. 189

[Report No. 108-147]

A BILL

To authorize appropriations for nanoscience,
nanoengineering, and nanotechnology research,
and for other purposes.

SEPTEMBER 15, 2003

Reported with an amendment